

## 5 Integrated Circuit I/O Pad Cell Modeling

ABSTRACT OF THE DISCLOSURE

10 A design system for modeling bi-directional pad cells,  
the interaction of internal pull cells/resistors with pad  
cells of all types, and the interaction of external pull  
cells/resistors with pad cells of all types. This modeling  
technique involves the use of three separate pins on each bi-  
directional pad cell: an input-only pin, an output-only pin,  
and a resolved pin. The input-only pin reflects the data that  
15 is supplied to the pad from external sources. The output-only  
pin reflects the data that is supplied as output from the pad  
cell (strong data from the output driver). The resolved pin  
reflects the combination of the input and the output data that  
are present, as well as the effect of resistive data supplied  
20 by pull-up/down resistors/cells. The output-only and resolved  
pins are implemented as internal or hidden pins within a pad  
cell model. These pins are included in the model for the I/O  
pad cells in a given library. The existing pad pin serves as  
the input-only pin. The model provides two modes of operation  
25 such that the same model can be used for either chip-level or  
system-level simulations.

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